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Two rationales for social security

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Prodigality and myopia. Two rationales for social security

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Abstract

Among the rationales for social security, there is the fact that some people have to be forced to save. To explain undersaving, rational prodigality and hyperbolic preferences are often cited but treated separably. In this paper we study those two particular behaviors that lead to forced saving within an optimal income tax second-best setting.

Keywords: social security, myopia, dual-self model, prodigality.

JEL Classification: H55, D91

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1 Introduction

Several rationales have been given for government involvement in social security. First, the government may wish to provide resources to the poor who are income constrained and would, without government help, be unable to support themselves in their later years. If society were made up only of the poor and the rich, the government could set up a means tested welfare type of system where resources were transferred from the rich to the poor. A second rationale for social security is the necessity of forcing some people, who are not poor and thus not income constrained, to save. This necessity arises from two different types of behavioral inclinations. Individuals try to balance two objectives: instant gratification and retirement planning. As behavioral economics shows, and more convincingly, the evidence found of insufficient saving in societies that do not have generous social security, individuals err on the side of using too much of their resources for instant gratification and not enough to plan for retirement. To try to address this problem the government can set up a non-means tested social security scheme that introduces inducements to get the "myopic" types to save more than they would have if the saving decision were left completely in their hands. In setting up a government run retirement system to induce the "myopics" to save, the government is also providing incentives for others in society to save more. These incentives will result in the poor having higher consumption in their retirement years than they would have had otherwise.

Once a government sets up a social security scheme that provides minimum pensions that can be means tested, an additional situation arises. When individuals know that the government will always bail out retirees without resources through minimum pensions that can be means tested, some individuals may try to consume all their resources during the first part of their lives, counting on the government to provide them with the minimum pension in their old age. One can speak of prodigality for these types who count on the intervention of the state to act as a "Good Samaritan" when they are old. Prodigality also provides a strong case fo a public pension system that forces these individuals to save for retirement. One way in which the government can reduce the incentives for individuals to act as prodigals is by reducing the size of the minimum pension. While such a policy will result in the potential prodigals increasing their saving (since it is now less worth their while to act as prodigals), the policy will also end up reducing the level of consumption of the poor in their retirement.

Myopia and prodigality both provide incentives for individuals to undersave for retirement. Thus, when these types of individuals are present a strong case can be made for a public pension system that forces these two types of individuals to increase saving. In inducing these individuals to change their behavior, however, the government will also have an effect on the other individuals in the economy. Myopia and prodigality have been studied separately. Myopia has been studied by Feldstein (1985) and more recently by Imorohoroglu *et al.* (1999). It has also received a lot of attention in recent years with the emergence of behavioral economics that explores the possible conflict between our preference for the long run and our short run behavior.[1]

There exists evidence that households have self-control problems in saving that calls for commitment devices such as social security. Quite interestingly, self-control problems vindicate an idea that was for long controversial, that of a paternalistic role for the government. Prodigality goes back to Hayek but has recently been discussed by Homburg (2000) and von Weizsacker (2003). It rests on the idea that in most societies there exists a means tested minimum pension that creates an incentive for some individuals not to save for old age and instead to free ride. Under some assumptions, prodigality should be addressed by a mandatory pension system.

The purpose of this paper is to combine these two sources of undersaving within an optimal income tax setting. As we show, self-selection constraints involving these two distortions have interesting implications regarding the size and the redistributiveness of the optimal pension system. For example, focusing on the welfare of the worse-off in society, we show that prodigality hurts the poor less than myopia; we also show that mixing prodigals and myopics hurts more the poor than just having only myopics or prodigals.

The rest of the paper is organized as follows. The next section presents the basic model and the first-best solution. Section 3 is devoted to the case of myopia without prodigality. Individuals there are committed to some consumption in the two periods of their life. In section 4, commitment is assumed away and we have prodigality. Numerical examples are given in section 5. A final section concludes.

2 The model. First-best and decentralization

We consider a two-period economy with a given interest rate (here equal to zero) and wage rates that differ by individual. There are four types of individuals that are distinguished according to their wage and time preference.

[1]See Angeletos *et al.* (2001), Diamond and Koszegi (2003), Cremer *et al.* (2006), Tenhunen and Tuomala (2006).

See also Cremer *et al.* (2007a,b) who adopt a linear tax schedule and a political economy approach respectively.

We consider a separable utility function:

$$U_i = u(c_i) + \beta\ u(d_i) - v(\ell_i)$$

where $u(\cdot)$ and $v(\cdot)$ are respectively strictly concave and convex, c_i and d_i denote first and second period consumption and ℓ_i is the labor supplied in the first period. The parameter β is a factor of time preference. In the second period individuals are retired.

Our four types are presented on Table 1.

Types	Wage rate	Time preference
H: high productivity	w_2	1
L: low productivity	w_0	1
M: myopic	w_2 or w_1	$0 \leqslant \beta < 1$
P: prodigals	w_1	1

Table 1 - Types of individuals

As an extreme case, we will take $\beta = 0$. We assume $w_2 > w_1 > w_0$. Here the myopic individual has either a high or a middle productivity, to keep the presentation simple. We thus have a society consisting of four types: productive and rational workers, myopic individuals with high or middle productivity, middle productivity workers and low productivity workers. Myopic individuals don't want to save because their immediate "self" incites them to get instant gratification. Yet their rational "self" would welcome a government inducing them to provide for their retirement. We do not allow the myopics to have low income because we want the government intervention to be due to their behavior and not to low income. Middle income individuals realize that a utilitarian government will always provide for the retirement of low productivity workers. If they could, they would be tempted to spend all their saving in the first period of their life and then, being penniless, claim assistance in old age. The prodigals are not allowed to have high productivity because the higher their income the harder it is for them to credibly pretend to be individuals with low income.

With $w_M = w_2$ and $\beta_M = 0$, the *laissez-faire* solution can be described very simply as:

$$c_H = d_H \ \ ; \ \ \ell_H \text{ is defined by } u'(c_H)\, w_2 - v'(\ell_H) = 0$$

$$c_M > c_H \ \ ; \ \ d_M = 0 \ \ ; \ \ \ell_M < \ell_H$$

$$c_P = d_P < c_H \ \ ; \ \ \ell_P < \ell_H$$

$c_L = d_L < c_P.$

The first two inequalities come from the fact that the myopic individuals focus on a single period. If $w_M = w_1, c_M \lesseqgtr c_H$ but $c_M > c_P$.

We now turn to the first-best solution. As alluded to above, the government has a non welfarist paternalistic objective; it does not take into account the preferences of the myopic, but rather those of his rational self with $\beta = 1$. The first-best problem can thus be simply written as the maximization of the following Lagrangean expression:

$$\begin{aligned}\mathcal{L}_1 &= \sum n_i \left[u(c_i) + u(d_i) - v\left(\frac{y_i}{w_i}\right) \right] \\ &\quad -\mu \sum n_i (c_i + d_i - y_i)\end{aligned}$$

where μ is the Lagrangean multiplier associated with the resource constraint, y_i denotes gross earning $(y_i = w_i \ell_i)$, and n_i is the fraction of workers of type i. With such an objective, the optimal allocation is standard:

$$\begin{aligned}c_i &= d_i = \text{constant for all} \\ \ell_H &> \ell_P > \ell_L; \ell_H = \ell_M \text{ for } w_M = w_2, \ell_M = \ell_P \text{ for } w_M = w_1.\end{aligned}$$

In other words, the more productive individuals end up with a lower utility. Can we decentralize such an optimum?

For types H, P and L a lump sum tax suffices. They will choose the optimal levels of consumption and labor supply. For type M, we have to distinguish the case of $\beta_M = 0$ from that of $\beta_M > 0$. When $\beta_M > 0$, an individualized *linear* saving subsidy σ can be introduced so that with $\sigma = 1 - \beta_M$, the *laissez-faire* condition

$$u'(c_M)(1-\sigma) = \beta_M \; u'(d_M)$$

is equivalent to the optimal solution:

$$u'(c_M) = u'(d_M).$$

When $\beta_M = 0$, *laissez-faire* saving is 0 and one has to resort to non linear subsidies or quantity control.

3 Second-best with commitment

In general, the above instruments are not readily available; governments do not have all the information concerning productivity, labor supply and preferences. We first consider the case where the government can commit to a policy for the two periods concerned. In other words, prodigality is not possible. As the government does not observe productivity nor preferences, it has to choose allocations which prevent certain types from mimicking other types to get a more attractive (c, d, y) package. We choose the parameters of our model in such a way that a limited number of self-selection constraints are binding.[2] We thus keep as binding self-selection constraints: HM, HP, HL, MP, ML, PL, and PM where, for example, HM means "type H is better off with his own package (c_H, d_H, y_H) than with that of type M (c_M, d_M, y_M). The type L's are the ones with the lowest productivity. They would love to switch places with the other types but they do not have the economic wherewithal to make such a switch feasible. Thus, one would not expect LH, LM, or LP to bind. We also assume that PH is not binding. If the type P's had high enough productivity that they would be better off than the type H's, it would be difficult for them to act a prodigals in the sense of pretending to be type L's. This consideration is irrelevant at this stage given that prodigality is assumed away. It will turn relevant in the following section. Lastly we assume that MH does not bind. If the myopics have sufficiently high productivity that they they feel that they are better off than the type H's, they are rich enough that they do not have to act as myopics. As in the previous section we assume that w_M is either w_2 or w_1.

[2] This selection is verified by our numerical examples, some of which are presented below.

3.1 The 4-type case

We now write the Lagrangean:

$$\begin{aligned}
\mathcal{L}_2 &= \sum n_i \left[u(c_i) + u(d_i) - v\left(\frac{y_i}{w_i}\right) - \mu(c_i + d_i - y_i)\right] \\
&+\mu_{HM}\left[u(c_H) + u(d_H) - v\left(\frac{y_H}{w_2}\right) - u(c_M) - u(d_M) + v\left(\frac{y_M}{w_2}\right)\right] \\
&+\mu_{HP}\left[u(c_H) + u(d_H) - v\left(\frac{y_H}{w_2}\right) - u(c_p) - u(d_p) + v\left(\frac{y_P}{w_2}\right)\right] \\
&+\mu_{HL}\left[u(c_H) + u(d_H) - v\left(\frac{y_H}{w_2}\right) - u(c_L) - u(d_L) + v\left(\frac{y_L}{w_2}\right)\right] \\
&+\mu_{MP}\left[u(c_M) - v\left(\frac{y_M}{w_M}\right) - u(c_P) + v\left(\frac{y_p}{w_M}\right)\right] \\
&+\mu_{PL}\left[u(c_P) + u(d_P) - v\left(\frac{y_P}{w_1}\right) - u(c_L) - u(d_L) + v\left(\frac{y_L}{w_1}\right)\right] \\
&+\mu_{ML}\left[u(c_M) - v\left(\frac{y_M}{w_M}\right) - u(c_L) + v\left(\frac{y_L}{w_M}\right)\right] \\
&+\mu_{PM}\left[u(c_P) + u(d_P) - v\left(\frac{y_P}{w_1}\right) - u(c_M) - u(d_M) + v\left(\frac{y_M}{w_1}\right)\right]
\end{aligned}$$

where i is an index that represents individuals.

The FOC's are presented in the appendix. Not surprisingly there is no distortion at the top, namely for individuals of type H. We thus have $c_H = d_H$ and $\dfrac{v'(\ell_H)}{u'(c_H)} = w_H$. Note that if there were no myopia, $c_i = d_i$ for all types. In other words, intertemporal choices would not be distorted. With myopia, we have:

$$\frac{u'(d_M)}{u'(c_M)} = 1 + \frac{u'(d_M)(\mu_{MP} + \mu_{ML})}{\mu\, n_M}$$

$$\frac{u'(d_P)}{u'(c_P)} = 1 - \frac{u'(d_P)\,\mu_{MP}}{\mu\, n_P}$$

$$\frac{u'(d_L)}{u'(c_L)} = 1 - \frac{u'(d_L)\,\mu_{ML}}{\mu\, n_L}.$$

In other words, myopia here implies that $c_M > d_M$, $c_L < d_L$ and $c_P < d_P$. In order to induce the myopic individuals to increase their consumption in the second period beyond what they would if there were no government incentives, both the low productivity individuals and the prodigal types will be persuaded to consume more in the second period than in the first. When $w_M = w_1$, the MP constraint is not binding and $c_P = d_P$.

Turning to the labor supply, we obtain:

$$\frac{1}{w_M}\frac{v'(y_M/w_M)}{u'(c_M)} = 1 - \frac{1}{w_M}v'(y_M/w_M)\frac{\mu_{HM}}{\mu n_M}\left[1 - \frac{\frac{1}{w_2}v'(y_M/w_2)}{\frac{1}{w_M}v'(y_M/w_M)}\right]$$
$$-\frac{1}{w_M}v'(y_M/w_M)\frac{\mu_{PM}}{\mu n_M}\left[1 - \frac{\frac{1}{w_1}v'(y_M/w_1)}{\frac{1}{w_M}v'(y_M/w_M)}\right] \leq 1$$

$$\frac{1}{w_1}\frac{v'(y_P/w_1)}{u'(c_P)} = 1 - \frac{1}{w_1}v'(y_P/w_1)\frac{\mu_{HP}}{\mu n_P}\left[1 - \frac{\frac{1}{w_2}v'(y_P/w_2)}{\frac{1}{w_1}v'(y_P/w_1)}\right]$$
$$-\frac{1}{w_1}v'(y_P/w_1)\frac{\mu_{MP}}{\mu n_P}\left[1 - \frac{\frac{1}{w_M}v'(y_P/w_M)}{\frac{1}{w_1}(y_P/w_1)}\right] < 1$$

$$\frac{1}{w_0}\frac{v'(y_L/w_0)}{u'(c_L)} = 1 - \frac{1}{w_0}\nu'(y_L/w_0)\frac{\mu_{PL}}{\mu n_L}\left[1 - \frac{\frac{1}{w_1}v'(y_L/w_1)}{\frac{1}{w_0}v'(y_L/w_0)}\right]$$
$$-\frac{1}{w_0}v'(y_L/w_0)\frac{\mu_{ML}}{\mu n_L}\left[1 - \frac{\frac{1}{w_M}v'(y_L/w_M)}{\frac{1}{w_0}v'(y_L/w_0)}\right]$$
$$-\frac{1}{w_0}v'(y_L/w_0)\frac{\mu_{HL}}{\mu n_L}\left[1 - \frac{\frac{1}{w_2}v'(y_L/w_2)}{\frac{1}{w_0}v'(y_L/w_0)}\right] < 1.$$

One should note that when $w_M > w_1$, constraint PM is not binding and so $\mu_{PM} = 0$. Moreover, when $w_M = w_2$, the wage rate of the high productivity type, there is no labor distortion for the myopic individual. However, when $w_M < w_2$, as for example when $w_M = w_1$, the myopic types are subject to a downward distortion. The above relationships also indicate that P and L are subject to a downward distortion. Note that when $w_M = w_1$, the last term in the MRS_P equation drops out but nonetheless there is still a labor distortion for the P types.

3.2 Commitment with no rich individuals

A special case of the above model occurs when there are no rich individuals. We look at the case where $w_M = w_1$, the myopic individuals face the same wage as the prodigal types. In that case MP does not bind although PM is likely to. Given that the prodigals cannot act as such, they behave in a standard way. From the first order conditions one notices that the myopic individuals would prefer to consume in period 1 and so $c_M > d_M$. The government policy that tries to shift some of the myopic's consumption to period one results in the poor consuming more in period 2 and so $c_L < d_L$. Lastly, the prodigals in this case act rationally and consume the same amounts in both periods, i.e., $c_P = d_P$.

Looking at the labor supply one notices that there is no labor distortion for either the myopic individuals or the prodigal types. In this case only the poor face a downward labor market distortion.

4 Second-best with non-commitment

We now turn to the case where some individuals have the possibility of consuming all their (disposable) earnings in the first period and then claiming in the second the benefit granted to the poor (here individuals of type L). For this to be possible we adopt the assumption that the government cannot observe that kind of strategic move by what we call the prodigals. Further, we assume that the potential prodigals do not have to mimick the poor in terms of earnings. This leads to the self-selection constraint:

$$u(c_P) + u(d_P) - u(c_P + d_P) - u(d_L) \geqslant 0.$$

This constraint *means* that the government can make a means test in the second period but cannot link the awarding of a minimum pension to lifetime resources. In this IC constraint both the mimicker and the mimicked have the same earnings.

In Appendix 1 we deal with the case where the prodigals mimick type L in terms of earnings as well. Namely:

$$u(c_P) + u(d_P) - v(y_P/w_1) - u(c_P + d_P) - u(d_L) + v(y_L/w_1) \geqslant 0.$$

For either case, we have not only the constraint PL, but also PM.

4.1 The 4-type case

In the case of non-commitment the Lagrangean when there is myopia can be written as:

$$\begin{aligned}
\mathcal{L}_3 &= \sum n_i \left[u(c_i) + u(d_i) - v\left(\frac{y_i}{w_i}\right) - \mu(c_i + d_i - y_i)\right] \\
&+\mu_{HM}\left[u(c_H) + u(d_H) - v\left(\frac{y_H}{w_2}\right) - u(c_M) - u(d_M) + v\left(\frac{y_M}{w_2}\right)\right] \\
&+\mu_{HP}\left[u(c_H) + u(d_H) - v\left(\frac{y_H}{w_2}\right) - u(c_p) - u(d_p) + v\left(\frac{y_P}{w_2}\right)\right] \\
&+\mu_{HL}\left[u(c_H) + u(d_H) - v\left(\frac{y_H}{w_2}\right) - u(c_L) - u(d_L) + v\left(\frac{y_L}{w_2}\right)\right] \\
&+\mu_{MP}\left[u(c_M) - v\left(\frac{y_M}{w_M}\right) - u(c_P) + v\left(\frac{y_P}{w_M}\right)\right] \\
&+\mu_{PL}\left[u(c_P) + u(d_P) - u(c_P + d_P) - u(d_L)\right] \\
&+\mu_{ML}\left[u(c_M) - v\left(\frac{y_M}{w_M}\right) - u(c_L) + v\left(\frac{y_L}{w_M}\right)\right] \\
&+\mu_{PM}\left[u(c_P) + u(d_P) - u(c_P + d_P) - u(d_M)\right]
\end{aligned}$$

where, as above, the wage of the myopic individuals, w_M, can take the values of either w_2 or w_1.

The FOC's for the case of non-commitment are given in Appendix 2.

As in the case with commitment, there is no distortion at the top. Moreover, if there were no myopia it is easy to see that $c_i = d_i$ for types H and P, but unlike the case with commitment, even with no myopia $c_i \neq d_i$ for types M and L. For types M one gets:

$$\frac{u'(d_M)}{u'(c_M)} = 1 + \frac{u'(d_M)\,\mu_{PM}}{\mu\, n_M}$$

and for types L one has

$$\frac{u'(d_L)}{u'(c_L)} = 1 + u'(d_L)\,\frac{\mu_{PL}}{\mu\, n_L}.$$

With myopia the results are:

$$\frac{u'(d_M)}{u'(c_M)} = 1 + \frac{u'(d_M)(\mu_{MP} + \mu_{ML} + \mu_{PM})}{\mu\, n_M}$$

$$\frac{u'(d_P)}{u'(c_P)} = 1 - \frac{\mu_{MP}}{\mu\, n_P}u'(d_p) + \frac{(\mu_{PL} + \mu_{PM})}{\mu\, n_P}u'(d_P + c_P)\left[\frac{u'(c_P) - u'(d_P)}{u'(c_P)}\right]$$

$$\frac{u'(d_L)}{u'(c_L)} = 1 - u'(d_L)\,\frac{\mu_{ML} - \mu_{PL}}{\mu\; n_L}.$$

When there is non-commitment and myopia $c_M > d_M$ and $c_P \leqslant d_P$. (When $w_M = w_1$, $c_P = d_P$ because in that situation the MP constraint is not binding.) There are two factors operating on the relationship between d_P and c_P. Myopia tends to make $d_P > c_P$ and the prodigality effect works to reduce the gap. Of course if there were no myopia, $c_P = d_P$.

It is not possible to determine the relationship between c_L and d_L theoretically for non-commitment. There are two factors that affect the relationship. When there are few myopic individuals in the economy relative to prodigals, $c_L > d_L$. In that case the government reduces d_L to lower the incentives for the prodigals to act as such. Of course in the process the government makes the type L's bear some of the burden from the policy of reducing incentives for the prodigals. On the other hand, when there is a preponderance of myopic individuals relative to prodigals, $c_L < d_L$. In this situation, the government by providing incentives for the myopics to increase their savings has this effect spill over to the poor who increase their saving as well.

For labor supply in the case of non-commitment we obtain:

$$\frac{v'(y_M/w_M)}{w_M\;u'(c_M)} = 1 - \frac{1}{w_M}v'(y_M/w_M)\,\frac{\mu_{HM}}{\mu n_M}\left[1 - \frac{\frac{1}{w_2}v'(y_M/w_2)}{\frac{1}{w_M}v'(y_M/w_M)}\right] \leqslant 1$$

$$\frac{v'(y_P/w_1)}{w_1\;u'(c_P)} = \frac{1-\frac{1}{w_1}v'(y_P/w_1)\frac{\mu_{HP}}{\mu n_P}\left[1-\frac{\frac{1}{w_2}v'(y_P/w_2)}{\frac{1}{w_1}v'(y_P/w_1)}\right]-\frac{1}{w_1}v'(y_P/w_1)\frac{\mu_{MP}}{\mu n_P}\left[1-\frac{\frac{1}{w_M}v'(y_P/w_M)}{\frac{1}{w_1}v'(y_P/w_1)}\right]}{\left\{1-\frac{\left(\mu_{PL+}\mu_{PM}\right)}{\mu n_P}[u'(c_P)-u'(c_P+d_P)]\right\}}$$

$$\begin{aligned}\frac{v'(y_L/w_0)}{w_0\;u'(c_L)} &= 1 - \frac{1}{w_0}v'(y_L/w_0)\,\frac{\mu_{ML}}{\mu n_L}\left[1 - \frac{\frac{1}{w_M}v'(y_L/w_M)}{\frac{1}{w_0}v'(y_L/w_0)}\right] - \\ &\quad \frac{1}{w_0}v'(y_L/w_0)\,\frac{\mu_{HL}}{\mu n_L}\left[1 - \frac{\frac{1}{w_2}v'(y_L/w_2)}{\frac{1}{w_0}v'(y_L/w_0)}\right] < 1.\end{aligned}$$

As in the case of commitment, when $w_M = w_2$, there is no labor market distortion for the myopic individuals. However, when $w_M = w_1$, the myopic individuals will face downward distortion. Individuals P and L are also subject to downward distortion, but less so than in the case of commitment.

(One should note that in our numerical examples with four individuals the P types were subject to a downward distortion; however, theoretically we cannot guarantee that in all cases the distortion will be downward. For example, when there are no rich individuals, see below, the government subsidizes the prodigals.)

4.2 Non-commitment with no rich individuals

A simplified version of the above model is to do away with the rich individuals. If one also assumes that the wage of the myopic individuals is the same as the wage of the prodigals, the complexity is greatly reduced. In that situation, $c_P = d_P$ and $c_M > d_M$. The relationship between c_L and d_L will depend on the relative numbers of the myopics and prodigals. When there are no myopics in the economy, $c_L > d_L$ and when there are no prodigals, $c_L < d_L$. One can find a proportion of the two types at which they just balance each other off so that $c_L = d_L$.

In terms of labor supply, the myopic individuals face no distortion whereas the poor individuals face a downward labor market distortion. For the prodigals, the marginal rate of substitution simplifies to:

$$\frac{\frac{1}{w_1} v'\left(y_P/w_1\right)}{u'\left(c_P\right)} = \frac{1}{\left\{1 - \frac{\left(\mu_{PL+}\mu_{PM}\right)}{\mu n_P}\left[u'\left(c_P\right) - u'\left(c_P + d_P\right)\right]\right\}} > 1.$$

Thus, for this particular example the government subsidizes the prodigals to work. By subsidizing the prodigals, the government is trying to reduce their incentives to mimick both L and M.

5 Numerical example

The discussion above indicates clearly that we are left with a number of ambiguous cases. To add some more insights we look at a numerical example with a log-linear utility function:

$$u\left(c, d, \ell\right) = \ln c + \ln d + \ln\left(1 - \ell\right).$$

We start with the three type case, namely with the case with no rich individuals.

5.1 The three type case

We start by using a simplified version of the non-commitment case where there are only three types: myopic and prodigal workers with $w_1 = 5$ and unskilled workers with $w_0 = 3$. Unskilled workers represent 25% of the whole population. The relative percentage of myopics, π, goes from 0 to 75%.

Table 2 gives some of the outcomes of this simulation. For each value of π, the first row gives the values of c and d and the binding constraints; the second row gives the utility levels and the third row the marginal rate of substitution between first period consumption and leisure.

We focus first on the two extreme cases ($\pi = 0$ and $.75$) and then turn to the intermediate cases. When there are no myopics, only the constraint PL is relevant. Type L is subject to a tax on his saving ($d_L < c_L$) but not on his labor supply; type P is not subject to a tax on saving but his labor is marginally subsidized. This odd outcome can be explained by the concern of not having type P behave as a prodigal. When there are no prodigals, we have the standard Stiglitz result for the labor supply: no distortion at the top and a tax on type L. Regarding the saving choice, M is taxed and L is subsidized. All these distortions occur to satisfy the only active self-selection constraint ML. In utility terms, type L is better off with $\pi = 0$ than with $\pi = .75$. In other words, myopia penalizes the poor more than prodigality. With myopia, the self-selection constraint implies that the poor consume more in the second period than in the first.

Turning to the intermediate cases, we first note that most variables don't evolve monotonically. Starting with the saving choice, we have $c_P = d_P$ for all values of π but $c_L \gtrless d_L$ for $\pi \lesseqgtr .25$; as to the myopics, $c_M - d_M$ is positive but decreases with π. Given that both constraints PM and PL are binding, $d_L = d_M$. For the poor, the utility reaches a minimum for $\pi = 45\%$.

Let us now look at the labor choice. There is no distortion on M, a downward distortion on L (except when $\pi = 0$) and an upward distortion on P that increases with π. As π increases, the utility of P increases; the utility of M and L first decrease and then increase.

Table 2
The 3 type case

% myopics		L	M	P	IC
0	c/d	1.93/1.52	-	2.02/2.02	PL
	U	-0.428	-	-0.401	
	MRS	3.00	-	5.73	
5		1.80/1.53	2.33/1.53	2.03/2.03	ML,PL,PM
		-0.447	-.0376	-0.401	
		2.57	5.00	5.92	
15		1.66/1.56	2.21/1.56	2.06/2.06	ML,PL,PM
		-0.473	-0.397	0.397	
		2.08	5.00	6.32	
25		1.58/1.59	2.14/1.59	2.10/2.10	ML,PL,PM
		-0.487	-0.409	-0.389	
		1.82	5.00	6.80	
35		1.53/1.63	2.09/1.63	2.16/2.16	ML,PL,PM
		-0.4936	-0.4142	-0.380	
		1.67	5.00	7.38	
45		1.49/1.68	2.06/1.68	2.22/2.22	ML,PL,PM
		-0.4945	-0.4142	-0.369	
		1.57	5.00	8.08	
55		1.47/1.74	2.04/1.74	2.30/2.30	ML,PL,PM
		-0.4909	-0.4103	-0.355	
		1.49	5.00	8.96	
65		1.45/1.81	2.02/1.81	2.40/2.40	ML,PL,PM
		-0.483	-0.4028	-0.340	
		1.44	5.00	10.08	
70		1.44/1.85	2.01/1.85	2.45/2.45	ML,PL,MP, PM
		-0.478	-0.3976	-0.252	
		1.42	5.00	10.91	
75		1.44/1.90	2.01/1.90	-	ML
		-0.472	-0.392	-	
		1.40	5.00	-	

5.2 The four-type case

We now add an additional type: the workers with productivity $w_2 = 10$. In the begining, we assume equal sizes for the four groups ($n_H = n_L = n_M = n_P$). Type H has a wage of 10, type P has 5 and type L, 3. Myopic individuals are given different wages $10, 7, 5$. Myopia means $\beta = 0$; otherwise, $\beta = 1$. We look at three cases wherein the myopic are given a wage rate $w_M = 10, 7, 5$.

In Table 3 the results for the case of commitment are presented. When the myopic individual has a discount factor $\beta_M = 1$, he is not myopic anymore.

In other words, example 3.1, 3.3 and 3.5 are standard examples of optimal income taxation. In 3.1, H and M are treated identically; in 3.5, M and P are also treated equally. The MRS between labor and consumption is to be compared with the wage rate. $MRS_H = 10$ is the standard non distortion value one obtains at the top. In 3.1, $MRS_L = 1.726 < 3$ and $MRS_P = 2.341 < 5$ implying a positive marginal income tax.

In Table 4 we present the results for non-commitment. Whereas in Table 3 the prodigals do not act as prodigals and so the main driving force for the results are the myopics, in Table 4 we can see how myopics and prodigals interact. A discussion of the results for Tables 3 and 4 follow the tables.

Table 3
Numerical example. Commitment

3.1. $\beta_M = 1$; $w_M = 10$

	c	d	y	MRS	U
H	2.840	2.840	7.587	10.000	-0.2068
L	2.069	2.069	1.740	1.726	-0.2619
M	2.840	2.840	7.586	10.000	-0.2068
P	2.210	2.210	3.004	2.341	-0.2373

3.2. $\beta_M = 0$; $w_M = 10$

	c	d	y	MRS	U
H	2.834	2.834	7.602	10.000	-0.2080
L	1.974	2.134	1.748	1.5214	-0.2668
M	2.951	2.508	7.302	10.000	-0.2080
P	1.990	2.508	3.080	1.8423	-0.2418

3.3. $\beta_M = 1$; $w_M = 7$

	c	d	y	MRS	U
H	2.826	2.826	7.623	10.000	-0.2096
L	1.847	1.847	1.920	1.6510	-0.3350
M	2.269	2.269	4.971	4.1807	-0.2579
P	2.026	2.026	3.423	2.6695	-0.2985

3.4. $\beta_M = 0$; $w_M = 7$

	c	d	y	MRS	U
H	2.760	2.760	7.806	10.000	-0.2241
L	1.854	1.992	1.896	1.609	-0.3113
M	2.488	1.981	5.017	5.667	-0.2742
P	1.945	2.378	3.440	2.396	-0.2766

3.5. $\beta_M = 1$; $w_M = 5$

	c	d	y	MRS	U
H	2.695	2.695	7.995	10.000	-0.2398
L	1.826	1.826	1.996	1.794	-0.3489
M	2.061	2.061	3.648	3.400	-0.3062
P	2.061	2.061	3.648	3.400	-0.3062

3.6. $\beta_M = 0$; $w_M = 5$

	c	d	y	MRS	U
H	2.683	2.683	8.031	10.000	-0.2429
L	1.715	1.970	2.008	1.514	-0.3489
M	2.157	1.952	3.624	3.822	-0.3076
P	2.046	2.046	3.590	3.173	-0.3052

Table 4
Numerical example. Without commitment

4.1. $\beta_M = 1$; $w_M = 10$

	c	d	y	MRS	U
H	2.682	2.682	8.033	10.000	-0.2431
L	2.277	1.568	1.900	3.000	-0.3401
M	4.421	1.568	4.873	10.000	-0.2431
P	2.074	2.074	4.540	6.679	-0.4024

4.2. $\beta_M = 0$; $w_M = 10$

	c	d	y	MRS	U
H	2.973	2.973	7.247	10.000	-0.1821
L	2.128	1.788	1.764	1.957	-0.2967
M	3.097	1.788	6.957	10.000	-0.2670
P	2.166	2.646	3.592	3.770	-0.2445

4.3. $\beta_M = 1$; $w_M = 7$

	c	d	y	MRS	U
H	2.781	2.781	7.746	10.000	-0.2193
L	2.254	1.668	1.920	3.000	-0.3202
M	3.170	1.668	4.225	7.000	-0.2628
P	2.206	2.206	4.842	9.7503	-0.4254

4.4. $\beta_M = 0$; $w_M = 7$

	c	d	y	MRS	U
H	2.857	2.857	7.539	10.000	-0.2033
L	1.963	1.701	1.896	1.910	-0.3425
M	2.703	1.701	4.953	7.000	-0.3039
P	2.164	2.349	3.907	4.835	-0.2907

4.5. $\beta_M = 1$; $w_M = 5$

	c	d	y	MRS	U
H	2.765	2.765	7.792	10.000	-0.2229
L	1.908	1.628	2.015	2.105	-0.3769
M	2.442	1.628	3.501	5.000	-0.3326
P	2.154	2.154	4.135	5.650	-0.3326

4.6. $\beta_M = 0$; $w_M = 5$

	c	d	y	MRS	U
H	2.766	2.766	7.788	10.000	-0.2237
L	1.874	1.626	2.020	2.009	-0.3830
M	2.412	1.626	3.545	5.000	-0.3382
P	2.151	2.151	4.019	5.169	-0.3205

In Table 5 one finds which self-selection constraints are binding. Note that for 3.5, PM and MP are identical. In cases 3.1, 3.3, and 3.5 where the discount factor, β_M, is equal to one, for all types of individuals one gets the result that $c = d$, the Atkinson-Stiglitz result which says that intertemporal choices will not be distorted.

Let us now turn to the case with myopia: tables 3.2, 3.4, and 3.6. When $\beta_M = 0$, there is no distortion at the top but Atkinson-Stiglitz no longer holds; as expected, one finds that $c_M > d_M$. Comparing 3.1 and 3.2, one sees that the paternalistic policy of forced saving generates a huge dividend for the myopic (in terms of his *ex post* utility). Since the myopic individual places weight on only consumption in period 1 and leisure, and period 1 consumption for the myopic individual as well as leisure is higher in table 3.2 than in table 3.1, his utility will be higher. The other three groups are penalized by such a policy and their utility decreases. (One should note, that if one uses the government's weight on the consumption for the myopic in periods one and two, (i.e., $\beta_M = 1$), utility falls for the myopic as well in going from table 3.1 to table 3.2.) When w_M is equal to 7 or 5, the impact on utility is less straight forward. The utility of the high productivity workers is reduced whenever the discount factor goes from 1 to 0. The utility of the L types is increased when $w_M = 7$ in going from Table 3.3 to Table 3.4 and stays the same when going from Table 3.5 to Table 3.6, i.e., when $w_M = 5$. Finally, the Prodigals see utility rise in going from Tables 3.2 to 3.3 and 3.4 to 3.5. (Note: in table 3 the Prodigals act as rational individuals.) The marginal tax on the earnings of L and P increases as a consequence of myopia.

The other result that one wants to take away from these tables is that when one has myopia and $w_M > 5$, the consumption of both the L types and the P types will be higher in the second period than in the first. This non-surprising result occurs because the incentives introduced to make the myopics consume more in the second period also provide incentives for the L and P types to increase their consumption in period 2. Even though the M types save less when they act as Myopics, overall savings are higher with Myopia than without. Thus, for example, overall consumption in period two is higher in Table 3.2 than in Table 3.1, and similarly is higher in Table 3.4 than in 3.3 and in Table 3.6 than in Table 3.5.

We now turn to the case of prodigality. So far we have compared the case where there is neither myopia nor prodigality to the case where there is myopia but no prodigality. Now we compare myopia with no prodigality to the case of prodigality and no myopia and finally to the situation when there is both myopia and prodigality.

In looking at the poor, the L types, one notices that when there are only myopics in the economy $d_L > c_L$ as noted above, but when there are only prodigals in the economy, $d_L < c_L$. In order to prevent the prodigals from emulating the poor, d_L needs to be kept small and thus one gets the result that $d_L < c_L$. When there are both Prodigals and Myopics in the economy d_L will still be smaller than c_L but the difference will not be as pronounced. The impact of the myopics is to encourage the poor to increase their saving, but that effect is not large enough to offset the reduction in d_L resulting from prodigality.

The introduction of prodigals also has profound effects on the M types even when they do not act as myopics. In Table 4.1 the consumption of the M types is much lower in period 2 than in period 1 even though $\beta_M = 1$. The value of d_M is low to prevent the Prodigals from emulating the M types. The gap, $c_M - d_M$, in fact, is larger in Table 4.1 than in Table 3.2 even though the M types act as myopics in Table 3.2 and do not do so in Table 4.1 These results continue to hold for different values of w_M. Thus, these results hold when comparing consumption levels of the M types in Tables 4.3 and 3.4 and in Tables 4.5 and 3.6.

It is interesting to note that when one has both Prodigals and Myopics, consumption of d_M by the myopics is higher than when one only has Prodigals. Also, the gap $c_M - d_M$ is smaller in Table 4.2 than in Table 4.1. With the intoduction of myopics in Table 4.2 the government implements policies to induce the myopics to postpone consumption to period 2. These policies also provide incentives for the L types and the P types to increase their consumption in period 2. The increase in consumption by the Prodigals in period 2 means that period 2 consumption by the low productivity workers and the myopics can be higher without the Prodigals having an incentive to emulate them. These results also hold in comparing Table 4.3 with Table 4.4. A comparison of Tables 4.5 and 4.6 shows that $c_M - d_M$ is also smaller in Table 4.6, however, one no longer gets the increase in d_M. When $w_M = 5$, even with myopics, government policies do not increase d_P as compared with c_P and so d_M cannot rise without there being an increased likelihood that the P's would try to emulate the M's. One should note that in this case the MP constraint is not binding and hence from the first order conditions one gets the result that $c_P = d_P$.

When there are prodigals but no myopics in the economy, the prodigals act rationally in the sense that they consume equal amounts in period one and two. These results are seen in Tables 4.1, 4.3, and 4.5. However, when one has both myopics and prodigals and $w_M > w_P$, consumption by the prodigals is greater in period 2 than in period 1 as noted in Tables 4.2 and 4.4.

The impact on the H-types of introducing prodigals is also interesting. In comparing the case of myopics with no prodigals (Table 3.2) with the one where there are prodigals but no myopics (Table 4.1), one notices that when there are prodigals the M-types consume much more in period one than in period 2 and consume a great deal of leisure (y is only 4.873). This behavior by the M-types means that even though they are very productive, MRS = 10, they consume much more than they earn and thus end up receiving transfers from the H-types. Thus, utility of the rich is lower when there are prodigals (Table 4.1) than in their absence (Tables 3.1 or 3.2).

Once one has both prodigals and myopics (Table 4.2), d_P is larger and so d_L and d_M will be higher as well. In this situation c_M is lower than when there are no myopics, leisure is lower, and in fact total consumption of the myopics $c_M + d_M$ will be less than the income of the myopics. Thus, transfers by the rich will be lower and their utility will be higher than in Tables 3.1, 3.2, or 4.1. Similar results arise when $w_M = 7$, although in this case utility is higher for the rich when there are neither myopics nor prodigals than when one only has prodigals. In the case of $w_M = 5$, the only change in the results is that d_P does not rise when one has both myopics and prodigals (Table 4.6) because the MP constraint is not binding. Thus while utility of the rich will be higher in Table 4.6 than in Tables 3.5 and 3.6, it is not higher than the utility of the rich in Table 4.5.

If the goal is to increase saving, i.e., consumption in period 2, myopics with no prodigals will result in the highest second period consumption. The introduction of prodigals reduces second period consumption. When there are both both myopics and prodigals in the economy, saving will be higher than without myopics except when $w_M = 5$, where the total amount of consumption in period 2 will be approximately the same whether one has just prodigals or both prodigals and myopics in the economy.

Table 5

Binding self-selection constraints

	HM	HL	HP	ML	MP	PL*	PM
Commitment 1	v		v		v	v	
2	v		v	v	v	v	
3	v				v	v	
4	v		v	v	v	v	
5	v		v	v	v	v	v
6	v		v	v		v	
No commitment 1	v		v		v	v	v
2			v	v	v	v	v
3			v		v	v	v
4			v	v	v	v	v
5			v	v	v	v	v
6			v	v		v	v

* Without commitment, PL implies that the prodigal does not consume c_P and d_P in the first period and d_L in the second: $u(c_P) + u(d_P) \geqslant u(c_P + d_P) + u(d_L)$.

Finally, Table 6 presents the results from a redistributive viewpoint, comparing the utility between L and H in the 4 scenarios considered. (The larger the number the larger the gap between the utility of the rich and the poor.)

Table 6

	No prodigals No myopic	No prodigals Myopic	Prodigals No myopic	Prodigals Myopic
$w_M = 10$	0.0551	0.0588	0.0970	0.1146
$w_M = 7$	0.1254	0.0872	0.1009	0.1392
$w_M = 5$	0.1091	0.1060	0.1540	0.1593

From table 6 it is clear that the worst case in terms of redistribution is to have both myopics and prodigals in the economy. Having only prodigals in the economy is better in terms of the utility gap between the rich and the poor than having both myopics and prodigals in the economy. However, having only myopics in the economy reduces the gap as compared to an economy where there are only prodigals. Thus, if one had a choice of the type of individuals to have in the economy, one would be better off with myopics than with prodigals. Lastly, it is interesting that there are cases where it is better to have myopics in the economy than to have neither the myopics nor the prodigals.

6 Conclusion

One of the traditional rationales behind public pensions is the need to force some individuals to save. It is argued that in the absence of public pensions, some people would not save enough and when retired, they would have to starve or to rely on social insurance. Why? Because at the time of saving, their view of retirement is too vague and dominated by an urgent need for instant gratification. Besides such behavior of bounded rationality, some other people who are perfectly rational, can strategically decide to consume all their earnings in their first period of life knowing that at retirement they can count on social assistance. In the first case a mandatory pension is viewed as a commitment device; in the second, it is viewed as a way of providing money for the poor in their old age but set up in such a way as to prevent non-poor rational individuals from abusing a program that is not aimed at them.

In general, these two questions are dealt with separately. In this paper we mix the two behaviors. We make the myopics meet the prodigals. The setting is that of optimal income taxation with two periods. The optimal scheme forces the myopics to save for retirement and the prodigals not to act as such. The interesting feature is that we have an increased number of possibilities of mimicking among individuals, rich and poor, rational and myopic, prodigals and nonprodigals. To avoid prodigality and to deal with myopia, different policies are needed. For the prodigals not to act as such, it is important not to have too a high pension for the poor and thus to make first period consumption relatively higher. To self-select the myopics, on the contrary, second period consumption can be high. As we show, the relative size of the myopics and of the prodigals plays an important role in the analysis. Not surprisingly, in our optimal income taxation framework, clearcut results cannot always be found. Hence we resort to a number of numerical simulations. However, there are a few conclusions that stand out.

When there are only myopics in the economy, government policies that try to make the myopics increase saving result in the poor consuming more in the second period than in the first, the middle class rational individuals tending to consume more in period two than in period one, and the myopics saving more than they would have in a *laissez-faire* situation. However, once one has prodigals in the economy the situation changes. In an economy with rich, poor, myopics, and prodigals, under optimal government policies, consumption of the poor in period 2 will be less than their consumpion in period one so that there will be less incentive for the prodigals to act as prodigals. This result will hold unless the myopics are a huge part of the population relative to the prodigals. On the other hand, the prodigals will consume more in period two than in period one. The incentives introduced to induce the myopics to increase their saving also have an effect on the prodigals to consume more in period two than in period one.

When there are myopics in the economy, government policy increases saving and, in fact, makes saving larger than with a government run pension fund where there are no myopics. When there are prodigals in the economy but no myopics saving will be much lower. The attempt to keep the prodigals from acting on their inclinations results in the reduced saving. Finally, when there are both prodigals and myopics in the economy, saving will be higher than when there are only prodigals but less than when there are only myopics.

One of the goals of public pensions is to improve redistribution. We find that the worst case in terms of redistribution is when one has both myopics and prodigals in the economy. The redistribution is better when one has only prodigals but it improves even more when there are only myopics. The reason for the poor showing in the case when there are both myopics and prodigals in the economy has as much to do with the improved showing of the wealthy because of lower transfers than by a worsened showing by the poor.

Myopic individuals consume less in period two than in period one. However, we find that when there are prodigals in the economy and constraint PM binds, even when there are no myopics in the economy $d_M < c_M$. Thus, in this case the M types appear to be acting as myopics even though there are no true myopics in the economy in this situation.

7 Appendix

Appendix 1. Observability of earnings

In the text of the paper it was assumed that there are no labor market effects in constraints PL and PM when there is non-commitment. Since it could be argued that labor market effects should be included in the constraints, we add these constraints in the appendix to show how the results are affected by such an addition.

With labor market interactions constraints PL and PM become:

$$u(c_P) + u(d_P) - v\left(\frac{y_P}{w_1}\right) - u(c_P + d_P) - u(d_L) + v\left(\frac{y_L}{w_1}\right) \geqslant 0.$$

$$u(c_P) + u(d_P) - v\left(\frac{y_P}{w_1}\right) - u(c_P + d_P) - u(d_M) + v\left(\frac{y_M}{w_1}\right) \geqslant 0.$$

The FOC for labor supply when the PL and PM constraints include labor market interactions become:

$$\frac{1}{w_M}v'\left(\frac{y_M}{w_M}\right)(n_M + \mu_{MP} + \mu_{ML}) - \frac{1}{w_2}v'\left(\frac{y_M}{w_2}\right)\mu_{HM} - \frac{1}{w_1}v'\left(\frac{y_M}{w_1}\right)\mu_{PM} = \mu\, n_M$$

$$\frac{1}{w_1}v'\left(\frac{y_P}{w_1}\right)(n_P + \mu_{PL} + \mu_{PM}) - \frac{1}{w_2}v'\left(\frac{y_P}{w_2}\right)\mu_{HP} - \frac{1}{w_M}v'\left(\frac{y_P}{w_M}\right)\mu_{MP} = \mu\, n_P$$

$$\frac{1}{w_0}v'\left(\frac{y_L}{w_0}\right)n_L - \frac{1}{w_2}v'\left(\frac{y_L}{w_2}\right)\mu_{HL} - \frac{1}{w_M}v'\left(\frac{y_L}{w_M}\right)\mu_{ML} - \frac{1}{w_1}v'\left(\frac{y_L}{w_1}\right)\mu_{PL} = \mu\, n_L$$

The marginal rate of substitution for labor supply then becomes:

$$\begin{aligned}\frac{\frac{1}{w_M}v'(y_M/w_M)}{u'(c_M)} &= 1 - \frac{1}{w_M}v'(y_M/w_M)\frac{\mu_{HM}}{\mu n_M}\left[1 - \frac{\frac{1}{w_2}v'(y_M/w_2)}{\frac{1}{w_M}v'(y_M/w_M)}\right] \\ &\quad + \frac{1}{w_1}v'\left(\frac{y_M}{w_1}\right)\frac{\mu_{PM}}{\mu n_M}\end{aligned}$$

$$\frac{\frac{1}{w_1}v'(y_P/w_1)}{u'(c_P)} = \frac{1-\frac{1}{w_1}v'(y_P/w_1)\frac{\mu_{HP}}{\mu n_P}\left[1-\frac{\frac{1}{w_2}v'(y_P/w_2)}{\frac{1}{w_1}v'(y_P/w_1)}\right]-\frac{1}{w_1}v'(y_P/w_1)\frac{\mu_{MP}}{\mu n_P}\left[1-\frac{\frac{1}{w_M}v'(y_P/w_M)}{\frac{1}{w_1}v'(y_P/w_1)}\right]}{\left\{1+\left(\mu_{PL+}\mu_{PM}\right)u'(c_P+d_P)\right\}}$$

$$\frac{\frac{1}{w_0}v'\left(y_L/w_0\right)}{u'\left(c_L\right)} = 1-\frac{1}{w_0}v'\left(y_L/w_0\right)\frac{\mu_{HL}}{\mu n_L}\left[1-\frac{\frac{1}{w_2}v'\left(y_L/w_2\right)}{\frac{1}{w_0}v'\left(y_L/w_0\right)}\right]$$
$$-\frac{1}{w_0}v'\left(y_L/w_0\right)\frac{\mu_{ML}}{\mu n_L}\left[1-\frac{\frac{1}{w_M}v'\left(y_L/w_M\right)}{\frac{1}{w_0}v'\left(y_L/w_0\right)}\right]+\frac{1}{w_1}v'\left(y_L/w_1\right)\frac{\mu_{PL}}{\mu n_L}$$

When one introduces labor market interactions, all the other equations derived for non-commitment remain the same as in the text.

In comparing the marginal rate of substitution for labor supply when there is no commitment without and with labor market interactions one finds that with no interactions $\frac{1}{w_M}v'\left(\frac{y_M/w_M}{u'\left(c_M\right)}\right) \leqslant 1$, $\frac{1}{w_1}v'\left(\frac{y_P/w_1}{u'\left(c_P\right)}\right) \lessgtr 1$, and $\frac{\frac{1}{w_0}v'\left(y_L/w_0\right)}{u'\left(c_L\right)} < 1$, and with labor market interactions $\frac{1}{w_M}v'\left(\frac{y_M/w_M}{u'\left(c_M\right)}\right) \lessgtr 1$, $\frac{1}{w_1}v'\left(\frac{y_P/w_1}{u'\left(c_P\right)}\right) < 1$, and $\frac{\frac{1}{w_0}v'\left(y_L/w_0\right)}{u'\left(c_L\right)} \gtrless 1$.

Table 7
Numerical example.
Without commitment but with Labor Market Interactions

7.1. $\beta_M = 1$; $w_M = 10$

	c	d	y	MRS	U
H	2.841	2.841	7.584	10.000	-0.2066
L	2.493	1.571	1.796	3.323	-0.3152
M	2.841	2.841	7.584	10.000	-0.2066
P	2.209	2.209	2.880	2.060	-0.2324

7.2. $\beta_M = 0$; $w_M = 10$

	c	d	y	MRS	U
H	2.869	2.869	7.508	10.000	-0.2009
L	2.055	1.581	1.825	1.954	-0.3528
M	3.027	2.454	7.117	10.000	-0.2017
P	2.069	2.466	2.939	1.798	-0.2289

7.3. $\beta_M = 1$; $w_M = 7$

	c	d	y	MRS	U
H	2.822	2.822	7.635	10.000	-0.2105
L	2.258	1.398	1.984	3.329	-0.4017
M	2.261	2.261	4.943	4.070	-0.2578
P	2.018	2.018	3.297	2.356	-0.2927

7.4. $\beta_M = 0$; $w_M = 7$

	c	d	y	MRS	U
H	2.785	2.785	7.737	10.000	-0.2185
L	1.931	1.483	1.982	2.077	-0.4091
M	2.582	1.969	4.913	5.949	-0.2646
P	2.007	2.336	3.245	2.209	-0.2601

7.5. $\beta_M = 1$; $w_M = 5$

	c	d	y	MRS	U
H	2.613	2.613	8.245	10.000	-0.2620
L	2.109	1.296	2.125	3.332	-0.4733
M	3.792	1.501	3.808	24.093	-0.3408
P	1.896	1.896	3.538	2.415	-0.3408

7.6. $\beta_M = 0$; $w_M = 5$

	c	d	y	MRS	U
H	2.713	2.713	7.941	10.000	-0.2353
L	1.788	1.450	2.122	2.023	-0.4565
M	2.504	1.762	3.815	6.974	-0.3255
P	2.022	2.129	3.204	2.177	-0.2748

Table 8

Binding self-selection constraints for labor market interactions

	HM	HL	HP	ML	MP	PL*	PM
No commitment 1	v		v		v	v	
2			v	v	v	v	
3	v				v	v	
4	v		v	v	v	v	
5	v				v	v	v
6			v	v	v	v	v

When there are labor market interactions in constraints PL and PM there are a few changes in the results that should be noted. In tables 7.1 and 7.3 constraint PM does not bind and thus $c_M = d_M$, whereas in the text in tables 4.1 and 4.3 constraint PM does hold yielding the result that $c_M > d_M$ even though there is no myopia. In table 7.5 PM does bind and so $c_M > d_M$, a result similar to table 4.5 in the text. In relation to the prodigals, there is a difference when $w_M = 5$. In table 4.6 MP does not bind yielding $c_P = d_P$, whereas in table 7.6 MP does bind and so $c_P < d_P$. The other difference relates to the MRS for labor supply. In table 4 there is no distortion in labor supply for type M's. However, in table 7, except when $w_M = 10$, there is a distortion. When $w_M = 7$, there is a downward distortion resulting from HM binding and when $w_M = 5$, there is a subsidy because PM binds. For the type L's the MRS for labor supply falls as long as constraint ML is binding (tables 4.2, 4.4, 4.5, and 4.6) and there are no labor market interactions; however, when there are labor market interactions, the direction is less clear. It falls in tables 7.2, 7.4, and 7.6 but rises in the others. As for the type P's, MRS falls when there are labor market interactions but in their absence rises in tables 4.1, 4.3, 4.5, and 4.6, but falls in tables 4.2 and 4.4.

Appendix 2. FOC conditions

FOC's of the case with commitment

$$u'(c_H)(n_H + \mu_{HM} + \mu_{HP} + \mu_{HL}) = \mu\ n_H$$
$$u'(d_H)(n_H + \mu_{HM} + \mu_{HP} + \mu_{HL}) = \mu\ n_H$$
$$\frac{1}{w_2}v'\left(\frac{y_H}{w_2}\right)(n_H + \mu_{HM} + \mu_{HP} + \mu_{HL}) = \mu\ n_H$$

$$u'(c_M)(n_M - \mu_{HM} + \mu_{MP} + \mu_{ML} - \mu_{PM}) = \mu\ n_M$$
$$u'(d_M)(n_M - \mu_{HM} - \mu_{PM}) = \mu\ n_M$$

$$\frac{1}{w_M}v'\left(\frac{y_M}{w_M}\right)(n_M + \mu_{MP} + \mu_{ML}) - \frac{1}{w_2}v'\left(\frac{y_M}{w_2}\right)\mu_{HM} - \frac{1}{w_1}v'\left(\frac{y_M}{w_1}\right)\mu_{PM} = \mu\ n_M$$

$$u'(c_P)(n_P - \mu_{HP} - \mu_{MP} + \mu_{PL} + \mu_{PM}) = \mu\ n_P$$

$$u'(d_P)(n_P - \mu_{HP} + \mu_{PL} + \mu_{PM}) = \mu\ n_P$$

$$\frac{1}{w_1}v'\left(\frac{y_P}{w_1}\right)(n_P + \mu_{PL} + \mu_{PM}) - \frac{1}{w_2}v'\left(\frac{y_P}{w_2}\right)\mu_{HP} - \frac{1}{w_M}v'\left(\frac{y_P}{w_M}\right)\mu_{MP} = \mu\ n_P$$

$$u'(c_L)(n_L - \mu_{PL} - \mu_{ML} - \mu_{HL}) = \mu\ n_L$$
$$u'(d_L)(n_L - \mu_{PL} - \mu_{HL}) = \mu\ n_L$$

$$\frac{1}{w_0}v'\left(\frac{y_L}{w_0}\right)n_L - \frac{1}{w_1}v'\left(\frac{y_L}{w_1}\right)\mu_{PL} - \frac{1}{w_M}v'\left(\frac{y_L}{w_M}\right)\mu_{ML} - \frac{1}{w_2}v'\left(\frac{y_L}{w_2}\right)\mu_{HL} = \mu\ n_L.$$

FOC's of the case without commitment

$$u'(c_H)(n_H + \mu_{HM} + \mu_{HP} + \mu_{HL}) = \mu\ n_H$$

$$u'(d_H)(n_H + \mu_{HM} + \mu_{HP} + \mu_{HL}) = \mu \, n_H$$
$$\frac{1}{w_2} v' \left(\frac{y_H}{w_2} \right) (n_H + \mu_{HM} + \mu_{HP} + \mu_{HL}) = \mu \, n_H$$

$$u'(c_M)(n_M - \mu_{HM} + \mu_{MP} + \mu_{ML}) = \mu \, n_M$$
$$u'(d_M)(n_M - \mu_{HM} - \mu_{PM}) = \mu \, n_M$$
$$\frac{1}{w_M} v' \left(\frac{y_M}{w_M} \right) (n_M + \mu_{MP} + \mu_{ML}) - \frac{1}{w_2} v' \left(\frac{y_M}{w_2} \right) \mu_{HM} = \mu \, n_M$$

$$u'(c_P)(n_P - \mu_{HP} - \mu_{MP} + \mu_{PL} + \mu_{PM}) - u'(c_P + d_P)(\mu_{PL} + \mu_{PM}) = \mu \, n_P$$
$$u'(d_P)(n_P - \mu_{HP} + \mu_{PL} + \mu_{PM}) - u'(c_P + d_P)(\mu_{PL} + \mu_{PM}) = \mu \, n_P$$
$$\frac{1}{w_1} v' \left(\frac{y_P}{w_1} \right) n_P - \frac{1}{w_2} v' \left(\frac{y_P}{w_2} \right) \mu_{HP} - \frac{1}{w_M} v' \left(\frac{y_P}{w_M} \right) \mu_{MP} = \mu \, n_P$$

$$u'(c_L)(n_L - \mu_{HL} - \mu_{ML}) = \mu \, n_L$$
$$u'(d_L)(n_L - \mu_{HL} - \mu_{PL}) = \mu \, n_L$$
$$\frac{1}{w_0} v' \left(\frac{y_L}{w_0} \right) n_L - \frac{1}{w_M} v' \left(\frac{y_L}{w_M} \right) \mu_{ML} - \frac{1}{w_2} v' \left(\frac{y_L}{w_2} \right) \mu_{HL} = \mu \, n_L.$$

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